

Name: _____

Problem	Points	Score
1a	5	
1b	5	
2a	5	
2b	10	
2c	10	
3a	10	
3b	10	
4	10	
5	20	
6a	5	
6b	5	
6c	5	
Total	100	

Notes:

1. The exam is closed book / closed notes. Students are allowed a copy sheet — only **one** side of **one** standard US-size (8.5" x 11") sheet of paper — on which they can write relevant information such as theorems.
2. Please show ALL work. Incorrect answers with no supporting explanations or work will be given no partial credit.
3. If I can't read or follow your solution, it is wrong, and no partial credit will be given — PLEASE BE NEAT!
4. Please indicate clearly your answer to every problem.
5. There is sufficient space after each problem to write your solution. In case you need extra paper please see the instructor.
6. Calculators of any kind are not allowed.

Problem No. 1:

- a) Convert the following number from decimal to octal, and then to binary.

$$265.375_{10}$$

- b)** Convert the following number from binary to hexadecimal and then to decimal.

$$1101000.011_2$$

Problem No. 2:

- a) Perform the following binary division. Clearly indicate the quotient and the remainder in the space provided.

$$10111001 \div 1101$$

Quotient: _____

Remainder: _____

- b)** Add the following two numbers in binary using a 5-bit 1's complement representation. Indicate if there is an overflow.

$$(-3) + (-11)$$

- c) Perform the following subtraction assuming 2's complement representation of the binary numbers. Indicate if there is an overflow.

$$10011 - 11010$$

Problem No. 3:

- a) Find the complement of F. Do **not** simplify the expression.

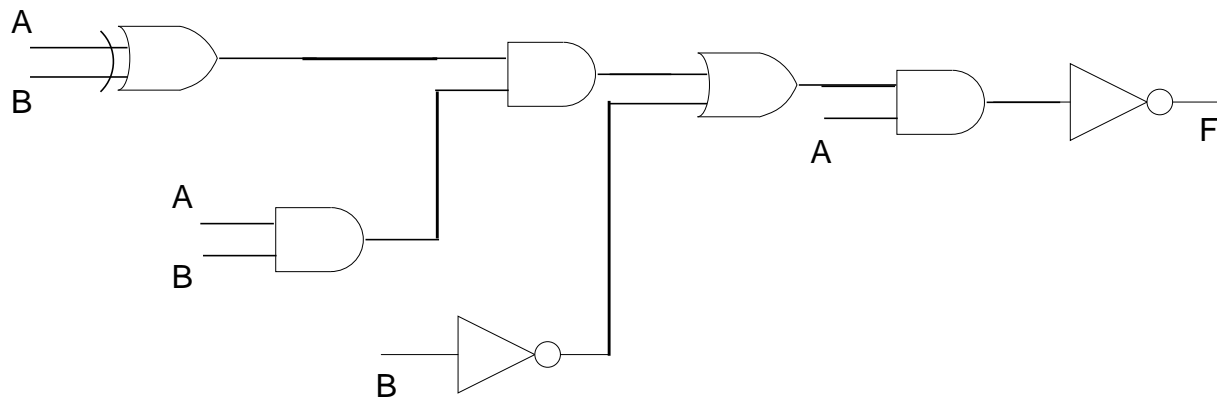
$$F = AB + (A' + C)(B + E')[D'E(A' + B) + 1]$$

- b)** Find the dual of F . Do **not** simplify the expression.

$$F = (A + B')(A'D' + E) + (AC' + BD)[(C + E')(B' + D) + 0]$$

Problem No. 4:

An electronics company wants to cut costs on a circuit being designed in its lab. It has organized a design competition for the students of ECE 3713 to simplify the following circuit and find the minimum expression for F. The winner has to draw a circuit diagram for this minimum form using at most two logic gates. Please send your entry for this competition.



Problem No. 5:

Assume that you have graduated and now run your own multi-billion electronics company that sells the following circuit —

$$(A \equiv B)(C + D') + (C \equiv D)(A + B')$$

As a smart engineer, you design the following circuit to save costs —

$$(C \oplus D)' + C(A \equiv B)$$

Now you need to check if the two circuits perform the same task. Do so by simplifying both expressions to a minimum form and compare if they are equal.

Problem No. 6:

A combinatorial switching network has four inputs A,B,C and D; and two outputs X and Y. The output X goes high if the representation ABCD has no two adjacent 1s, otherwise it is 0. Y equals 1 if there are no two adjacent 0s in the representation ABCD, otherwise it is low.

- a) Construct a truth table for this network.

b) Provide a maxterm representation for X.

c) Provide a minterm representation for Y.